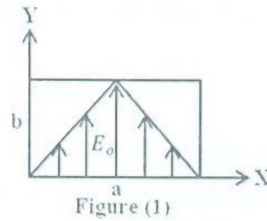


Answer the following questions:

(Time: 3 hours)

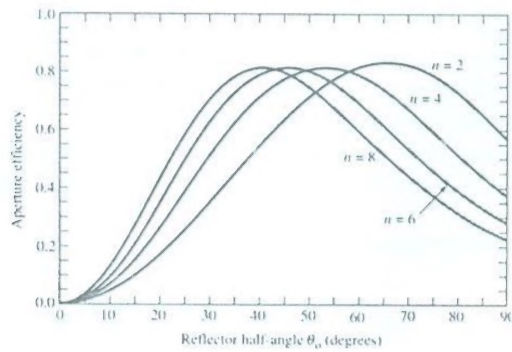
Question (1)

- State the advantages of the aperture antennas. State the main parameters that affect the radiation pattern of the aperture antenna.
- For  $(5\lambda \times 3\lambda)$  rectangular aperture antenna, if the electric field is distributed as shown in figure (1). Determine and sketch the E-plane and H-plane patterns. Determine the antenna directivity.



Question (2)

- Derive the expression that relates the parabolic reflector antenna parameters  $(F, d, \theta_0)$ .
- The parabolic antenna is used for high power applications, discuss.
- A parabolic reflector antenna with  $F/d = 0.5$  has a prime-focus feed with a gain function  $G(\theta) = 14 \cos^n(\theta)$ . Evaluate the order  $n$  of the feeder. Find the diameter of the reflector in order to obtain an antenna gain of 30dB at 10GHz. Find the antenna efficiency.



Question (3)

- Write down the general expression of the array factor of a uniform feeding linear antenna array consisting of  $N$  antenna elements with uniform element spacing  $d$  then,

**Derive** the necessary condition to avoid the appearance of the grating lobes in the end-fire case.

(b) **Design** an end-fire array such that no grating lobes exist in the field pattern with peak-side lobe to main lobe ratio is less than 0.24.

1. If the array elements are arranged along Y-axis, and the elements are short monopoles oriented in Z-direction, plot the array factor and resultant field pattern.
2. Determine the HPBW and the directivity of the array.
3. If it is required to steer the main lobe towards  $\theta_o = 45^\circ$ , design the feeding network.

**Question (4)**

- (a) Consider a broadside Tschebyscheff array consisting of  $N = 5$  antenna elements with side lobe level  $SLL = -16dB$  and uniform element spacing  $d = \lambda/2$ . **Determine** the excitation coefficients of the array elements and **plot** the array factor. **State** the main disadvantage of the Tschebyscheff array.
- (b) A  $(6 \times 4)$  planar antenna array having progressive phase shifts of 0, and  $-\pi/2$  in X-direction and Y-direction respectively. The elements spacing are  $dx = dy = \lambda/2$ . **Determine** the main lobe direction. **Determine** the array directivity. **Sketch** the total field in (x-y), (x-z), and (y-z) planes if the elements of the array are dipoles oriented in X-direction.

**Question (5)**

- (a) **Briefly discuss** the following points:
1. Microstrip antennas have high quality factor.
  2. Microstrip antennas have polarization impurity.
  3. The aperture coupling feed technique.
- (b) **Design** a rectangular microstrip antenna using substrate (FR4) with relative permittivity  $\epsilon_r = 4.7$  and height  $h = 0.8cm$  so as to resonate at 8GHz.

**Hint; use the following relation**

$$\frac{\Delta L}{h} = 0.412 \frac{(\epsilon_{eff} + 0.3) \left( \frac{W}{h} + 0.264 \right)}{(\epsilon_{eff} - 0.258) \left( \frac{W}{h} + 0.8 \right)}$$

*With my best wishes*

*Dr. Amr Hussein*



Tanta University

Department of Electronics and  
Electrical Communication  
Engineering



Faculty of Engineering

Course: Satellite Communication Systems

Course Code: EEC4122,

Students: 4<sup>th</sup> year

Date: Sat, 12-Jan-2013,

Time Allowed: Three hours,

No. of Pages: 2,

Total Marks: 125 Marks

**Answer the following questions:**

(Constants and charts are found at the end of the pages)

**First question:**

**[30 marks]**

Write short notes on the following terms:

- |                     |   |
|---------------------|---|
| a) Apogee,          | f) Retrograde orbits,                       |
| b) Perigee,         | g) Polar orbits                             |
| c) Line of upsides, | h) Satellite orbital perturbations.         |
| d) Inclination,     | i) Steps for launching a satellite into the |
| e) Prograde orbits, | Geostationary orbit.                        |

**Second question:**

**[20 Marks]**

- The Mars planet's radius is 0.533 of the Earth's radius and its day is 1.026 of the Earth's day. Find the radius of the geostationary orbit for that planet and the speed of a satellite orbits in that orbit? If the satellite that launched into that orbit moves on a plane that is inclined by 4 degrees compared to the ideal geostationary calculated in a), what is the time required for a complete cycle?
- For a satellite transmission path, the angle of elevation of the earth station antenna is  $30^\circ$ , and the earth station is situated at mean sea level. The signal is circular polarized at a frequency of 18 GHz. The rain height is 1.2 km, and a rain rate of 12 mm/h is exceeded for 0.001 percent of the year. Calculate the rain attenuation under these conditions.

**Third question:**

**[35 Marks]**

- When the RF signals are transmitted between the satellite and an earth station, what are the sources of signal attenuation that affect the signal?
- For a receiving end of a satellite link, there are different sources of noise. What are these noise sources?
- A receiving system consists of an antenna having a noise temperature of 50 K, feeding directly into a LNA. The amplifier has a noise temperature of 110 K and a gain of 40 dB. The coaxial feeder between the LNA and the main receiver has a loss of 2 dB, and the main receiver has a noise figure of 9 dB. Calculate the system noise temperature referred to input.



- d) A LNA has three cascaded stages with gains 10 dB, 30 dB, 15 dB respectively and effective noise temperatures of 120 K, 150 K, 250 K. Find the best arrangement of these stages for least overall noise temperature.

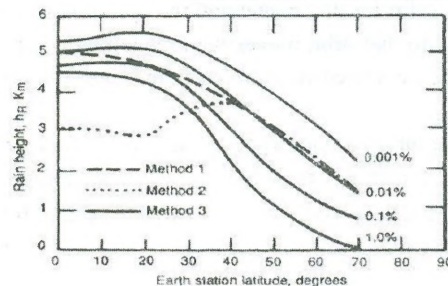
**Fourth question:**

**[40 Marks]**

- As an earth station creates a wireless link to the satellite, an access technique should be used that should fit to the nature of transmitted data. What are the access techniques commonly used to access a satellite? Explain briefly the operation of each.
- Drive an expression for the transmission throughput of pure Aloha and slotted Aloha, indicating the maximum attainable throughput in each case.
- A common communication channel for access a satellite via an Aloha technique. The maximum data rate for the channel is 200 Mbps. For pure and slotted Aloha find:
  - The maximum throughput
  - The channel load at which the maximum throughput occurs
  - If each earth station offers an average rate of 512 Kbps. How many earth stations can utilize the channel at the maximum throughput point?

**Some useful constants:**

Earth's radius	6371 Km
$\mu$	$3.986005 \times 10^{14} \text{ m}^3/\text{s}^2$
$K_1$	66,063.1704 Km <sup>2</sup>



Reduction Factors	
For $p = 0.001\%$	$r_{0.001} = \frac{10}{10 + L_G}$
For $p = 0.01\%$	$r_{0.01} = \frac{90}{90 + 4L_G}$
For $p = 0.1\%$	$r_{0.1} = \frac{180}{180 + L_G}$
For $p = 1\%$	$r_1 = 1$

**Specific Attenuation Coefficients**

Frequency, GHz	$a_h$	$a_v$	$b_h$	$b_v$
1	0.0000387	0.0000352	0.912	0.88
2	0.000154	0.000138	0.963	0.923
4	0.00065	0.000591	1.121	1.075
6	0.00175	0.00155	1.308	1.265
7	0.00301	0.00265	1.332	1.312
8	0.00454	0.00395	1.327	1.31
10	0.0101	0.00887	1.276	1.264
12	0.0188	0.0168	1.217	1.2
15	0.0367	0.0335	1.154	1.128
20	0.0751	0.0691	1.099	1.065
25	0.124	0.113	1.061	1.03
30	0.187	0.167	1.021	1

*Good Luck*



Tanta  
University

Department: Electronics and Electrical Communication Eng.  
Total Marks: 90 Marks



Faculty of  
Engineering

Course Title: Telecommunication Networks  
Date: 16/1/ 2013

Course Code: EEC 4124  
Allowed time: 3 hours

Year: 4<sup>th</sup>  
No. of Pages: (2)

Remarks: (answer the following questions ... assume any missing data ... answers should be supported by equations and sketches)

Question (1)

- (a) Define the following terms: Arrival call rate, inter-arrival time, GoS, and call congestion.
- (b) Discuss the following statement "The steady state condition for traffic is achieved under statistical equilibrium".
- (c) Given a switching system that normally experiences four arrivals per minute, what is the probability that eight or more arrivals occur in an arbitrary chosen 30 sec interval?
- (d) An exchange with 12 channels handling 200 call trials per hour with 2 minutes expected duration. What is the probability that two calls are offered during 1 minute? If the overflow traffic is offered to another switch with 6 channels, what is the probability that both switches are blocked simultaneously? Compare this answer to the blocking probability of an exchange of 18 channels. Comment on your results.

Question (2)

- (a) Apply the following sentence for loss system "Time congestion doesn't necessitate call congestion".
- (b) Consider an M/M/N delay system; deduce an expression for the delay traffic.
- (c) Consider a single channel delay system M/M/1; deduce an expression for the following parameters: probability of finding j call trials, delay probability, and average number of customers in the system.
- (d) Consider a single channel delay system. In a busy hour, 18 calls are offered to the system, each of 2 minutes duration. Calculate
  - i. The probability that an arriving call is delayed
  - ii. The average number of customers that may exist in the system.
  - iii. The probability that there are more than 5 users in the system.
  - iv. The average system time.

Question (3)

- (a) Sketch the timing diagram for circuit switching and packet switching system (datagram and virtual circuit).
- (b) Show the effect of packet size on the transmission time for virtual circuit packet switching system, give an example.
- (c) Show the way in which cross points in a switching system can be reduced, give an example.

(d) Consider the transfer of a file of 2 Mbit from a source to a destination with five nodes between them. The data rate of all links is 9600 bps. The packet size is 48 bytes and the overhead address is 5 bytes. The setup time is 0.02 sec. The processing time at each node is 0.006 sec, while the average queuing delay is 0.03 sec. The propagation speed on the link is  $200\text{ m}/\mu\text{sec}$ , while the hop distance is 30 km. Calculate the end-to-end delay time for the following cases:

- (i) Circuit switching network.
- (ii) Datagram packet switching network.
- (iii) Virtual circuit packet switching network with ack.,  $P_{\min} = 60\text{ bits}$ .

Question (4)

- (a) What are the functions of signaling system?
- (b) Compare between In-Channel and Common Channel Signaling (CCS).
- (c) What are the operation modes of CCS?
- (d) Explain the following sentence "The routing strategy determines the nature of the tradeoff between efficiency and resilience"
- (e) Compare between alternate routing and adaptive routing.

*Best Wishes of Success*



# Erlang B Traffic Table

N/B	Maximum Offered Load Versus B and N											
	B is in %											
	0.01	0.05	0.1	0.5	1.0	2	5	10	15	20	30	40
1	.0001	.0005	.0010	.0050	.0101	.0204	.0526	.1111	.1765	.2500	.4286	.6667
2	.0142	.0321	.0458	.1054	.1526	.2235	.3813	.5954	.7962	1.000	1.449	2.000
3	.0868	.1517	.1938	.3490	.4555	.6022	.8994	1.271	1.603	1.930	2.633	3.480
4	.2347	.3624	.4393	.7012	.8694	1.092	1.525	2.045	2.501	2.945	3.891	5.021
5	.4520	.6486	.7621	1.132	1.361	1.657	2.219	2.881	3.454	4.010	5.189	6.596
6	.7282	.9957	1.146	1.622	1.909	2.276	2.960	3.758	4.445	5.109	6.514	8.191
7	1.054	1.392	1.579	2.158	2.501	2.935	3.738	4.666	5.461	6.230	7.856	9.800
8	1.422	1.830	2.051	2.730	3.128	3.627	4.543	5.597	6.498	7.369	9.213	11.42
9	1.826	2.302	2.558	3.333	3.783	4.345	5.370	6.546	7.551	8.522	10.58	13.05
10	2.260	2.803	3.092	3.961	4.461	5.084	6.216	7.511	8.616	9.685	11.95	14.68
11	2.722	3.329	3.651	4.610	5.160	5.842	7.076	8.487	9.691	10.86	13.33	16.31
12	3.207	3.878	4.231	5.279	5.876	6.615	7.950	9.474	10.78	12.04	14.72	17.95
13	3.713	4.447	4.831	5.964	6.607	7.402	8.835	10.47	11.87	13.22	16.11	19.60
14	4.239	5.032	5.446	6.663	7.352	8.200	9.730	11.47	12.97	14.41	17.50	21.24
15	4.781	5.634	6.077	7.376	8.108	9.010	10.63	12.48	14.07	15.61	18.90	22.89
16	5.339	6.250	6.722	8.100	8.875	9.828	11.54	13.50	15.18	16.81	20.30	24.54
17	5.911	6.878	7.378	8.834	9.652	10.66	12.46	14.52	16.29	18.01	21.70	26.19
18	6.496	7.519	8.046	9.578	10.44	11.49	13.39	15.55	17.41	19.22	23.10	27.84
19	7.093	8.170	8.724	10.33	11.23	12.33	14.32	16.58	18.53	20.42	24.51	29.50
20	7.701	8.831	9.412	11.09	12.03	13.18	15.25	17.61	19.65	21.64	25.92	31.15
21	8.319	9.501	10.11	11.86	12.84	14.04	16.19	18.65	20.77	22.85	27.33	32.81
22	8.946	10.18	10.81	12.64	13.65	14.90	17.13	19.69	21.90	24.06	28.74	34.46
23	9.583	10.87	11.52	13.42	14.47	15.76	18.08	20.74	23.03	25.28	30.15	36.12
24	10.23	11.56	12.24	14.20	15.30	16.63	19.03	21.78	24.16	26.50	31.56	37.78
25	10.88	12.26	12.97	15.00	16.13	17.51	19.99	22.83	25.30	27.72	32.97	39.44
26	11.54	12.97	13.70	15.80	16.96	18.38	20.94	23.89	26.43	28.94	34.39	41.10
27	12.21	13.69	14.44	16.60	17.80	19.27	21.90	24.94	27.57	30.16	35.80	42.76
28	12.88	14.41	15.18	17.41	18.64	20.15	22.87	26.00	28.71	31.39	37.21	44.41
29	13.56	15.13	15.93	18.22	19.49	21.04	23.83	27.05	29.85	32.61	38.63	46.07
30	14.25	15.86	16.68	19.03	20.34	21.93	24.80	28.11	31.00	33.84	40.05	47.74
31	14.94	16.60	17.44	19.85	21.19	22.83	25.77	29.17	32.14	35.07	41.46	49.40
32	15.63	17.34	18.21	20.68	22.05	23.73	26.75	30.24	33.28	36.30	42.88	51.06
33	16.34	18.09	18.97	21.51	22.91	24.63	27.72	31.30	34.43	37.52	44.30	52.72
34	17.04	18.84	19.74	22.34	23.77	25.53	28.70	32.37	35.58	38.75	45.72	54.38
35	17.75	19.59	20.52	23.17	24.64	26.44	29.68	33.43	36.72	39.99	47.14	56.04
36	18.47	20.35	21.30	24.01	25.51	27.34	30.66	34.50	37.87	41.22	48.56	57.70
37	19.19	21.11	22.08	24.85	26.38	28.25	31.64	35.57	39.02	42.45	49.98	59.37
38	19.91	21.87	22.86	25.69	27.25	29.17	32.62	36.64	40.17	43.68	51.40	61.03
39	20.64	22.64	23.65	26.53	28.13	30.08	33.61	37.72	41.32	44.91	52.82	62.69
40	21.37	23.41	24.44	27.38	29.01	31.00	34.60	38.79	42.48	46.15	54.24	64.35
41	22.11	24.19	25.24	28.23	29.89	31.92	35.58	39.86	43.63	47.38	55.66	66.02
42	22.85	24.97	26.04	29.09	30.77	32.84	36.57	40.94	44.78	48.62	57.08	67.68
43	23.59	25.75	26.84	29.94	31.66	33.76	37.57	42.01	45.94	49.85	58.50	69.34



Electronics and Electrical Comm. Dept.  
Total Marks: 85 Marks



Elective Course (3): Information Security

Course Code: EEC4126

Date: Jan, 20th 2013 (First Term)

No. of Pages: (2)

Year: 4th

Allowed Time: 3 hrs

**Question 1:**

- What is the meant by physical security? State its disadvantage.
- What is the difference between information hiding and cryptography?
- In the 3DES encryption process, why is the middle portion a decryption rather than an encryption?
- Decrypt the following cipher if it was encrypted using Caesar Cipher: "GOODLUCK".

**Question 2:**

- Draw the Output feedback (OFB) mode which is used for encryption for symmetric block ciphers? What are the characteristics of this mode?
- A digital signature provides for non-repudiation while MAC does not explain why?
- Consider the Diffie-Hellman key exchange protocol. Assume now that Oscar runs an active man-in-the-middle attack against the key exchange. For the Diffie-Hellman key exchange, Use the parameters  $p = 29$ ,  $g = 2$ , and  $x = 10$ ,  $y = 6$  for Alice and Bob, respectively.  
Oscar uses the value  $z = 5$ . Compute the key pairs  $K_{AO}$  and  $K_{BO}$  indicating:
  - The formulas with which Oscar computes them.
  - The formulas with which Alice and Bob compute them.
  - What is the solution to this attack?
- In a public key system, Alice has the keys ( $n=77$ ,  $e=11$ ,  $d= 11$ ), Bob has ( $n=77$ ,  $e=7$ ,  $d= 43$ ). Alice wants to send the word "HOPE" to Bob;  
It will digitally sign the message then encrypt it using RSA. Each single character will be a block. Obtain the whole transmitted message .

**Question 3:**

- What are the characteristics of hash function? State which of these characteristics is necessary for security against: attack over channel & sender forgeability & stealing file of password .

P.T.O

Pages 1/2



- b) Assume a fast public-key library such as OpenSSL that can decrypt data at a rate of 100 Kbit/sec using the RSA algorithm on a modern PC. On the same machine, AES can decrypt at a rate of 17 Mbit/sec. Assume we want to decrypt a movie stored on a DVD. The movie requires 1 GByte of storage. How long does decryption take with either algorithm? Comment on the result.
- c) Explain how Bob can send encrypted message to Alice using El-gamal algorithm? And how Alice can decrypt it?
- d) What is the primary advantage of using timestamps in an authentication protocol? What is the primary disadvantage of using timestamps?
- 

**Question 4:**

- a) What problem was Kerberos designed to address? How many servers it has and what is the role of each?
- b) Suppose all passwords on a given system are 6 characters long and that each character can have any one of 26 different values. Now suppose Trudy has a password cracking program that can try 64 passwords per second.
1. How many different possible passwords?
  2. How long, on average, will it take Trudy to find the administrator password using brute-force attack?
- c) Consider the SSL protocol:
1. What is the abbreviation of SSL protocol?
  2. In which layer we use SSL protocol?
  3. What is the practical application for SSL in real time?
  4. What are the security services provided by SSL protocol?
  5. Draw the steps of handshake protocol.
  6. Explain the function of change cipher spec protocol.
  7. Explain the function of alert protocol.
  8. Draw the processing of record protocol.
  9. Draw how to create cryptographic secrets in SSL.
- d) Draw detailed graph for PGP.
- e) Draw the hybrid network.

-----Good Luck, Dr Salah Khames-----

أجب عن الأسئلة الآتية:- (٤٠ درجة)  
السؤال الأول :-

- ١- ماهي العلاقة بين دراسة الجدوى والتخطيط الاستراتيجي .
- ٢- اكتب نبذة مختصرة عن الجدوى الفنية للمشروع .
- ٣- تكلم بالتفصيل عن عناصر التصنيع .

السؤال الثاني :-

- ٢- لماذا نقوم بإعداد دراسات الجدوى الاقتصادية؟ مع شرح تفصيلي لأنواع دراسات الجدوى الاقتصادية.

٢- تكلم عن :-

- (١) - العوامل المؤثرة في حجم مرونة الطلب .
- (ب) - الخطوط اللازمة لتخطيط مصنع جديد .
- ٣- ما هي فوائد إجراء التقييم البيئي؟ وما هي خطوات معالجة الآثار البيئية للمشروع .

السؤال الثالث :-

تبلغ تكاليف إحدى معدات التشييد مبلغ \$٦,٠٠٠ ، ويتوقع أن تكون عمرها ٦ سنوات بدون قيمة متبقية عند نهاية عمرها. وقد قدرت مصروفات الصيانة والتأمين والصيانة والوقود والتزييت بمبلغ \$١,٥٠٠ للنسبة الأولى ، \$١,٧٠٠ للثانية ، وتستمر في الزيادة بعد ذلك بمقدار \$٢٠٠ لكل سنة تالية. فما هي التكلفة السنوية المنتظمة المكافئة لهذه المعدة إذا كان معدل الربح هو ١٢%؟

السؤال الرابع :-

- ١- ما المقصود ب المخزون ؟ - ولماذا نحتفظ بالمخزون؟
- ٢- تكلم باختصار عن وظائف الإدارة الخمسة .
- اكتب نبذة مختصرة عن التقرير الخاص بك.

مع أطيب التمنيات بالنجاح  
د/د عبد الفتاح مصطفى خورشيد